Illinois Department of Transportation

CADD Roadway Drafting Reference Guide

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Reference Guide

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Prepared by Bureau of Bridges and Structures
Division of Highways

Published by Illinois Department of Transportation

Springfield, Illinois

August 15, 2014
Continually Updated Resource

Document Control and Revision History

The CADD Roadway Drafting Reference Guide is owned by the Illinois Department of Transportation Bureau of Bridges and Structures. The guide is reviewed during use and updated by the Bureau of Bridges and Structures, as necessary.

All changes in the main body of the guide are identified with a vertical line in the outside margin of the page.

Interim changes are communicated through the IDOT CADD Support subscription service. Copies are available electronically on the IDOT web site.

Archived versions of this guide are available to examine in the Policy and Research Center, Room 320 of the Hanley Building.

Electronic
Portable Document Format (PDF) has been selected as the primary distribution format, and the official version of the guide is available on the Policy & Research Center Library site on InsideIDOT.

Hard Copy
This guide is not distributed in hard copy format. Users of this guide who choose to print a copy of the guide are responsible for ensuring use of the most current version.

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1. Introduction

Pursuant to Illinois Department of Transportation Policy BBS-14, this policy has been established to promote the development of highway improvement projects in a consistent and efficient manner.

This document supersedes all previous versions of the IDOT CADD Roadway Drafting Reference Guide.

The guidelines within this document provide MicroStation, GEOPAK, and other roadway detailing information that shall be used in the preparation of roadway plans for the Illinois Department of Transportation. It is intended to be used in conjunction with the IDOT CADD Roadway and Structure Project Deliverables Policy as well as the Bureau of Design and Environment Manuals and documents.

For current versions of CADD software used by the Department and additional information, refer to the Support tab under the Roadway CADD Downloads and Guidelines.

2. MicroStation Information

2.1 MicroStation

IDOT has selected MicroStation and GEOPAK for its Department-wide computer-aided drafting and design software package, which is used to generate most contract plans. This document provides the Department's CADD criteria for plan development (e.g., cell library, levels, text styles). Using MicroStation's levels and reference files allows various users within the Department to work on the same set of plans without interfering with each other's design work. By integrating or linking MicroStation with other software packages (e.g., GEOPAK, AutoTURN, databases), the designer can use the computer to perform the actual design and layout of a project and calculate the quantities.

2.2 Configuration

Engineering Systems at IDOT has created a CADD environment (for MicroStation and GEOPAK) which contains a basic configuration and necessary resource files for the preparation of roadway and structure plans. This environment is available under the Requirements of the Support tab on the Roadway CADD Downloads and Guidelines site as a single download entitled "IDOTCAD_V2011.exe". To use the IDOT CADD environment, refer to the "ReadMeNow.pdf" file and the "IDOTCAD_Directories.pdf" file contained within the executable file.

When beginning any project, verify that the latest configuration files, resource files, cell libraries and dgnlib's are installed. This can be accomplished via a comparison of installed files to those currently available from the IDOT CADD Support web page (i.e. through date, file size, etc.). Another way to verify currency is to be an active participant in the IDOT CADD Support Subscription Service. Subscribers are notified through e-mail whenever changes have been made to the contents of the CADD Support site or the Roadway CADD Guidelines site. Refer to Section 5.2 for information on where to sign up for the Subscription Service.

2.3 Resource Files

Included in the CADD environment are various files used to display linework and text symbology properly in design files. Over the course of changes to the Department CADD system, it has become necessary to carry historical resource data in the event that previous files are used on a current project.

Resource files necessary for the preparation of roadway plans are as follows:

- E99Lstly.rsc: Pre-MicroStation v8 IDOT English custom line styles (e####)
- fontlib.rsc: IDOT's custom font library for roadway and structure projects
- IDOTcolor.tbl: IDOT color table for all roadway plans
- IDOTlines.rsc: Current IDOT roadway line styles used by IDOTLevel2011.dgnlib (See Figure 2.3-2 through Figure 2.3-5 for images)
- M99Lstyl.rsc: Pre-MicroStation v8 IDOT Metric custom line styles (m####)
- Oppstyle.rsc: Current mapping custom line styles

- Scales.def: Definition file for setting the annotation scale. See Figure 2.3-1 for table of standard scales used in roadway plans
- Units.def: Units definition files for selecting the proper working units

Engineering Scales			
Ratio	Scale		
1:6000	1"	=	500'
1:2400	1"	=	200'
1:1200	1"	=	100'
1:600	1"	=	50'
1:480	1"	=	40'
1:360	1"	=	30'
1:240	1"	=	20'
1:120	1"	=	10'
1:60	1"	=	5'
1:24	1"	=	2'

Figure 2.3-1 Standard Engineering scales used in roadway plans

LC	IMAGE	USED BY LEVEL
0107		Topo_Guardrail
0108		Topo_Base of Levee
0111		Topo_Noise Wall or Levee
0120		ROW_EX_County or Township Lines
0120		ROW_EX_Section Lines
0127		ROW_EX_Property Dashed Lines
0134		Design_PR_Railroad Track
0134		Topo_Railroad Active Track
0136		Drainage_PR_Profile Rightside
0136		ROW_EX ROW Line
0137		Utilities_EX_Underground Sanitary Sewer
0137		Utilities_PR_Underground Sanitary Sewer
0148		Signals_EX_Underground Cable
0148		Signals_PR_Underground Cable
0221		Topo_Railroad Abandon Track
0241		Not Assigned
0265		Topo_Woods and Brush
0277		Not Assigned
0280		Not Assigned
0400		ROW_PR ROW Line
0420		Design_PR_Guardrail
0425		Stage_# Construction Edge Drums
0425		Stage_Construction Edge Drums
0433		IDS_Pavement Joint Sawed
0437		IDS_Pavement Joint Keyed
0439		Design_PR_Aggregate Shoulder
0440		IDS_Pavement Joint Keyed without Bars
0447		Removal_Linear Items
0448		Drainage_PR_Pipe Underdrain
0486		Alignment_EX_## Centerline
0486		Alignment_PR_## Centerline
0486		Alignment_PR_Alternate
0486		Alignment_PR_Detour
0486		Stage_# Construction Centerline
0486		Stage_Construction Centerline
0493		Landscaping_Fences
0493		Topo_Fence
0497		Drainage_EX_Pipe Underdrain
0519		Signals_EX_Underground Conduit
0519		Signals_PR_Underground Conduit

Figure 2.3-2 Line Styles used by roadway levels

LC	IMAGE	USED BY LEVEL
0550	——T——T——T——T——	Utilities_EX_Underground Telephone
0550	——T——T——T——T——	Utilities_PR_Underground Telephone
0551	——E——E——E——E——	Utilities_EX_Underground Electric
0551	——E——E——E——E——	Utilities_PR_Underground Electric
0557	⊢——⊣W⊢——⊣ ⊢——⊣W⊢——⊣	Utilities_EX_Underground Water
0557	⊢——⊣W⊢——⊣ ⊢——⊣W⊢——⊣	Utilities_PR_Underground Water
0558	⊢——⊣G⊢——⊣ ⊢——⊣G⊢——⊣	Utilities_EX_Underground Gasline
0558	⊢——⊣G⊢——⊣ ⊢——⊣G⊢——⊣	Utilities_PR_Underground Gasline
0559	⊢——⊣O⊢——⊣ ⊢——⊣O⊢——⊣	Utilities_EX_Underground Oil
0559	⊢——⊣O⊢——⊣ ⊢——⊣O⊢——⊣	Utilities_PR_Underground Oil
0595	～～～～～～～～～～～～	Not Assigned
0683	——O——O——O——	Not Assigned
0718	——G——G———	Not Assigned
0726	——A——A——A——A	Lighting_EX_Aerial Cable
0726	——A——A——A——A	Lighting_PR_Aerial Cable
0726	——A——A——A——A	Utilities_EX_Aerial Lines
0726	——A——A——A——A	Utilities_PR_Aerial Lines
0730	————— — ——— — ——— — —	Lighting_EX_Cable in Duct
0730	————— — ——— — ——— — —	Lighting_PR_Cable in Duct
0745	≡≡≡≡≡≡≡≡≡	Lighting_EX_Conduit
0745	≡≡≡≡≡≡≡≡≡	Lighting_PR_Conduit
0763	——o——o——o——o——	Landscaping_Mowline
0778	/////////////////////////////	ROW_EX_Easement
0778	/////////////////////////////	ROW_PR_Permanent Easement
0779	77 77 77 77 77 77 77 77 77 77 77	ROW_PR_Temporary Easement
0781	⌒⌒⌒⌒⌒⌒⌒⌒⌒⌒	Topo_Vegetation Line
0782	——————————————————	Topo_Water Edge
0904	·· ·· ·· ·· ·· ·· ·· ··	Topo_PMK Skip Dash Line
0905	— — — — —	Not Assigned
0906	- - - - - - - - - - - - - - - - -	Design_PR_PMK Dotted Line
0910	≡≡≡≡≡≡≡≡≡	Design_PR_PMK Double Centerline
0912	···	Topo_PMK Stop Line
0913	⫻⫻⫻⫻⫻⫻⫻⫻⫻⫻⫻⫻	Design_PR_PMK Stop line
0933	▶——▶——▶——▶——▶——▶	Drainage_PR_Storm Sewer
0936	———— ———— ———— —	Not Assigned
0937	—— —— —— —— —— ——	Not Assigned
1006	——FO——FO——FO——FO——	Utilities_EX_Underground Fiber Optic
1006	——FO——FO——FO——FO——	Utilities_PR_Underground Fiber Optic
1008	——CTV——CTV——CTV——CTV——	Utilities_EX_Underground CableTV
1008	——CTV——CTV——CTV——CTV——	Utilities_PR_Underground CableTV
1010	——▷——▷——▷——▷——▷——▷	Drainage_EX_Storm Sewer
1200	⬚⬚⬚ ⬚⬚⬚ ⬚⬚⬚ ⬚⬚⬚ ⬚⬚⬚ ⬚⬚⬚ ⬚⬚⬚ ⬚⬚⬚	Drainage_EX_Aggregate Ditch
1200	⬚⬚⬚ ⬚⬚⬚ ⬚⬚⬚ ⬚⬚⬚ ⬚⬚⬚ ⬚⬚⬚ ⬚⬚⬚ ⬚⬚⬚	Drainage_PR_Aggregate Ditch
1205	—·—·—·—·—·—·—·—·—·—·—	Erosion Control_Clearing and Grading
1210	⌒⌒⌒⌒⌒⌒⌒⌒⌒⌒⌒	Erosion Control_Dike
1230	⋀⋀⋀⋀⋀⋀⋀⋀⋀⋀⋀⋀	Erosion Control_Fence

Figure 2.3-3 Line Styles used by roadway levels

LC	IMAGE	USED BY LEVEL
1245	— xxx — xxx — xxx — xxx — xxx — xxx — xxx — xxx — xxx — xxx — xxx — xxx — xxx	Erosion Control_Temporary Fence
1250		Drainage_EX_Paved Ditch
1250		Drainage_PR_Paved Ditch
1255		Erosion Control_Perimeter Barrier
1300		Design_PR_PMK Skip Dash Yellow
1300		HS_PMK_Skip Dash
1305		Design_PR_PMK Skip Dash White
1310		Design_PR_PMK CL Markers 40
1312		Landscaping_Shrubs
1313	——— L ——— L ——— L ———	Lighting_EX_Buried Cable
1313	——— L ——— L ——— L ———	Lighting_PR_Buried Cable
1314		Topo_PMK Double Centerline
1315		Design_PR_PMK CL Markers 80
1316		Topo_PMK Dotted Line
1320		Design_PR_PMK LaneLine Marker 40
1325		Design_PR_PMK LaneLine Marker 80
1330		Design_PR_PMK LaneLine Dbl Markers
1335		Design_PR_PMK 2Way Left Turn Lane
1340		Design_PR_PMK CL Multilane
1350	——————— XS ——————— —	ROW_PR_Excess Property Limits
1352	——————— AC ———————	ROW_EX_Access Control
1354	——— ——— AC ——— ———	ROW_EX_Access Control and ROW
1355	— x ——— x ——— AR ——— x ———	ROW_EX_Access Control and ROW with Fence
1356	——————AC——————	ROW_PR_Access Control
1358	—— — — — —AC— ——— — — -	ROW_PR_Access Control and ROW
1359	———x—x—x———x—AC—x———x—x—x	ROW_PR_Access Control and ROW with Fence
1360		Design_PR_Concrete Barrier
1360		Topo_Concrete Barrier
1361		Not Assigned
1372	——————— AR ———————	Not Assigned
1374	——— ——— ——— —	Not Assigned
1375	——— x ——— x ——— x ——— x —	Not Assigned
1400	⊢— — — —+— — — —+— — — —+— — —	Topo_Railroad Abandon Lg_scale
1402	⊢——— ⊢ ——— ⊢ ——— ⊢	Topo_Railroad Active Lg_scale
1404		Topo_Levee Lg_scale
1500	~~~~~~~~~~~~~~~~~~~~	Stage_# Construction Sheet Piling
1500	~~~~~~~~~~~~~~~~~~~~	Stage_Construction Sheet Piling
1503		Topo_Cable Barrier
1504		Design_PR_Cable Barrier
1505	——————— — — — — — —	ROW_EX_Quarter Section Lines
1506	——————— — — — —	ROW_EX_Quarter Quarter Section Lines
1601	∋〉—∋〉—∋〉—∋〉—∋〉—∋〉—∋〉—∋〉—∋〉—∋〉—∋〉—∋〉—	Utilities_EX_Underground Combined Sewer
1602	⁄——E——⁄——E——⁄——E——⁄——E——	Utilities_AB_Underground Electric
1603	⁄—⊣G⊢—⁄—⊣ ⊢—⁄—⊣G⊢—⁄—⊣ ⊢—	Utilities_AB_Underground Gasline
1604	⁄—⊣O⊢—⁄—⊣ ⊢—⁄—⊣O⊢—⁄—⊣ ⊢—	Utilities_AB_Underground Oil
1605	⁄—⊣W⊢—⁄—⊣ ⊢—⁄—⊣W⊢—⁄—⊣ ⊢—	Utilities_AB_Underground Water
1606	⁄—— CTV ——⁄—— CTV ——⁄—— CTV ——⁄—— CTV ——	Utilities_AB_Underground CableTV
1607	—— FO ——⁄—— FO ——⁄—— FO ——⁄—— FO ——	Utilities_AB_Underground Fiber Optic
1608	—∋〉⁄—∋〉⁄—∋〉⁄—∋〉⁄—∋〉⁄—∋〉⁄—∋〉⁄—∋〉⁄—∋〉⁄—∋〉⁄—∋〉⁄—	Utilities_AB_Underground Sanitary Sewer
1609	—— T ——⁄—— T ——⁄—— T ——⁄—— T ——	Utilities_AB_Underground Telephone
1610		Not Assigned

Figure 2.3-4 Line Styles used by roadway levels

1700		Drainage_EX_Drainage Boundary
1700		Drainage_PR_Drainage Boundary
1701		Drainage_EX_Divide Area
1702		Drainage_EX_Floodway Boundary
1702		Drainage_PR_Floodway Boundary
1703		Drainage_EX_Floodplain Boundary
1703		Drainage_PR_Floodplain Boundary

Figure 2.3-5 Line Styles used by roadway levels

2.4 Dgnlib Files

Dgnlib's are design library files with predefined settings. When an element is placed in a design file, MicroStation "looks" to the dgnlib for that element's predefined properties or settings. Once placed, they become part of the active design file. If changes are made to the dgnlib, those changes are not automatically updated in the design file. However, all or part of the settings can be updated from a revised dgnlib by executing the key-in command "dgnlib update (all, dimstyles, levels, etc.)". The available dgnlib's are:

- BridgeStyles.dgnlib:
  - Contains the following text styles:
    - Br1:001scale100: superscripts and subscripts
    - Br1:001scale140: general text and dimension text
    - Br1:001scale200: titles
    - Br1:001scale_boring: text for soil boring logs (in-house)
    - Br1:001scale_TOS_Elev: top of slab elevation text for tables
  - Contains the following dimension styles:
    - Bridge1:001: basic dimension style
- IDOT_DrawManager.dgnlib:
  - Contains the Element Templates used by the IDOT Drawing Manager (replaces previous IDOT Settings Manager)
- IDOT_DrawManagerTasks.dgnlib:
  - Contains Drawing Manager tasks.
- IDOTLevel2011.dgnlib - contains all of the levels with assigned symbology settings for the different disciplines within IDOT
- IDOTLevelGISImport.dgnlib: Contains levels for importing GIS information.
- IDOTMenu.dgnlib: Contains the IDOTMenu tab which contains various programs and commands used for roadway design.
- IDOTStdCheck.dgnlib – Required for use with Standards Checker
- MappingStyles.dgnlib (Office of Planning and Programming – Internal use):
  - Contains mapping text styles and multi-line styles.
- PrintOrganizer.dgnlib:
  - Contains the following Print Styles:
    - Standard 11x17 Laser
    - Standard 11x17 PDF
    - Standard Find Print Shape
    - Standard NoDataFields
- Rdwy_Text.dgnlib:
  - Contains the following text styles:
    - Rdwy_exhibit100
    - Rdwy_exhibit120
    - Rdwy_exhibit140
    - Rdwy_exhibit175
    - Rdwy_schedule100
    - Rdwy_schedule120
    - Rdwy_schedule140
    - Rdwy_schedule175
    - Rdwy_SOQ140
    - Rdwy_text100
    - Rdwy_text120
    - Rdwy_text140
    - Rdwy_text175

- Rdwy_title200
- Rdwy_title240
- Rdwy_title350
- Rdwy_title500
- Rdwy_xsect120
- Rdwy_xsect140
- Rdwy_xsect175
- Rdwy_xsect200
    - o Contains the following dimension styles:
        - Roadway120 (General roadway dimensions)
        - Roadway140 (Highway Standard dimensions)

2.5 Levels / Symbology

Levels and Filters are set up in the file "IDOTLevel2011.dgnlib" for each department discipline (bridge, roadway, mapping, aerial survey, etc.) within IDOT. All symbologies are preset within this design library (dgnlib file). Attributes include name, color number, line style and weight for each level. Before placing elements into a design file, first select the desired level. After selection, all of the associated symbology will be automatically set. (Note that the attribute buttons for color, line style and weight are required to be set to "By Level" in order for the automatic setting of symbologies).

Filters have been set up to make it easier to locate a particular discipline's group of levels. The Filter tool, located on the Attributes Toolbar, allows users to define the group of levels viewed within the Level Manager or Level Display dialogs.

For most projects, the levels already created suffice in the preparation of plans. There are unique situations that may require levels that do not already exist. For these situations, Level 1 through Level 63 may be used.

Fig. 2.5-1 lists the major prefixes used in the naming of levels. A complete list of all of IDOT's levels and their settings is included as an archived web page (mht) file within the IDOT configuration discussed in Section 2.2.

Level Prefix	General description of use
Aerial Survey	Aerial Surveys elements
Alignment	Existing and Proposed alignment elements
Bridge	Structure elements (on structure portion of plans only)
Construction	Proposed changes to contract during construction
Design	Proposed roadway elements
Drainage	Drainage related elements
Environmental	Environmental elements
Erosion Control	Erosion control elements
HS	Highway Standards elements (internal use only)
IDS	Intersection design elements
Landscaping	Landscaping elements
Level # (1-63)	MicroStation v7 conversion levels
Lighting	Lighting elements
Mapping	Mapping elements (OP & P - Internal use)
Removal	Removal elements
ROW	ROW elements
Sheets	Sheet elements
Signals	Traffic signal elements
Soils	Geotechnical elements
Stage_1 Construction	Stage 1 construction elements
Stage_2 Construction	Stage 2 construction elements
Stage_3 Construction	Stage 3 construction elements
Stage_4 Construction	Stage 4 construction elements
Stage Construction	Stage construction elements
Structures	Structure elements (on roadway portion of plans only)
Topo	Topography elements
Utilities	Utility elements
XS	Cross section elements
XSC	Cross section criteria elements

Figure 2.5-1 Roadway level groups

2.6 Text Styles

The absence of guidance concerning the placement of text has, over time, led to the inconsistent, sometimes shoddy, appearance of contract plans (regardless of origin). In an attempt to remedy this, we have set up Text Styles within MicroStation as well as example plans to aid in some sort of standardization.

Text Styles are a feature in MicroStation which simplifies and standardizes the placement of text. When placing text, selecting a text style automatically adjusts the text settings. When used, it is not necessary to manually change font, text height, text width, line spacing or other properties independently. It is only necessary to identify the scale and turn on the Annotation Scale lock when a drawing is started. Information on how to do this is discussed later in this section.

An additional benefit to using Text Styles is the ability to modify the style in the dgnlib file where it is defined and globally make changes to a design file using the "dgnlib update" command. As an example, it may become necessary to move away from our custom IDOT fonts created in the 1980's, which are currently used, to a TrueType font and

incorporate it into the existing Text Styles. Should this become necessary, we now have the ability with Text Styles to modify the text of a design file without requiring much, if any, cleanup.

Text styles are not currently supported by GEOPAK or the Axiom products used internally by the Department. They are to be supported in future releases; however, there is no time frame for their implementation. For this reason, it would be difficult to make their use mandatory. At this time, we are only specifying preferred Text Styles (or their equivalent) that are to be used within roadway design plans. The default settings of the text styles are generally to be used even if the text styles themselves are not used. An exception might be in over-riding the justification. These settings are listed in the table of Figure 2.6-1.

Roadway Text Styles and Settings						
Text Style Name	font	height (inches)	width (inches)	line spacing (inches)	underline	justification
Rdwy_schedule100	40	0.100	0.100	0.080	no	Left-Center
Rdwy_schedule120	40	0.120	0.120	0.096	no	Left-Center
Rdwy_schedule140	40	0.140	0.140	0.112	no	Left-Center
Rdwy_schedule175	40	0.175	0.175	0.140	no	Left-Center
Rdwy_SOQ140	40	0.140	0.140	0.448	no	Left-Center
Rdwy_text100	32	0.100	0.100	0.080	no	Left-Center
Rdwy_text120	32	0.120	0.120	0.096	no	Left-Center
Rdwy_text140	32	0.140	0.140	0.112	no	Left-Center
Rdwy_text175	32	0.175	0.175	0.140	no	Left-Center
Rdwy_title200	115	0.200	0.200	0.160	no	Center-Center
Rdwy_title240	115	0.240	0.240	0.192	yes	Center-Center
Rdwy_title350	115	0.350	0.350	0.280	no	Center-Center
Rdwy_title500	115	0.500	0.500	0.400	no	Center-Center
Rdwy_xsect120	30	0.120	0.120	0.096	no	Left-Center
Rdwy_xsect140	30	0.140	0.140	0.112	no	Left-Center
Rdwy_xsect175	30	0.175	0.175	0.140	no	Left-Center
Rdwy_xsect200	30	0.200	0.200	0.160	no	Left-Center

Figure 2.6-1 Text Style settings for ANSI D-size roadway plans

The labeling tools in GEOPAK do not use text styles, but have the text settings as well as other attributes set up within a Labeling Style File (lsf). These labeling tools are briefly discussed in Section 3.12 and Section 3.14. The D&C Manager does make use of the text styles via an mvba created by the Department. The mvba is discussed later in this section.

Seventeen text styles have been set up for use in the preparation of roadway plans. It is not intended for them all to be used in each set of plans. Figure 2.6-2 lists all of the text styles and identifies the preferred text styles, listing where they are generally to be used. This, in conjunction with the example plans available on the Roadway CADD Downloads and Guidelines are to be used in identifying what text styles should be used throughout roadway plans. The text styles that do not have a use specified are intended for unique situations that might require them. An example would be with a plan sheet covering a larger area than what is customary. In a situation such as this, the Rdwy_text100 text style (or equivalent) could be used in place of Rdwy_text120 for the plan text so that the dimensions and callouts would be clear. In other words, good judgment should dictate

the text styles used; although every effort should be made to follow our preferred text styles.

Text styles	Use
Rdwy_schedule100	
Rdwy_schedule120	Generally used for text in schedules and tables
Rdwy_schedule140	
Rdwy_schedule175	
Rdwy_SOQ140	Summary of Quantities
Rdwy_text100	
Rdwy_text120	Generally used for plan text
Rdwy_text140	Highway Standard text
Rdwy_text175	
Rdwy_title200	
Rdwy_title240	Generally used for titles and cross section stationing
Rdwy_title350	Highway Standard sheet title
Rdwy_title500	Cover sheet
Rdwy_xsect120	Generally used for cross section text
Rdwy_xsect140	Cross section grid offset text
Rdwy_xsect175	Cross section grid elevation text
Rdwy_xsect200	

Figure 2.6-2 Preferred Text Style usage

Prior to using text styles within a design file, two things must be done. First, the annotation scale must be set. Secondly, the Annotation scale toggle must be turned on.

In order to use text styles properly, one must understand that they have been set up relative to the ANSI D-sized border which is literally 22" x 34". The borders that exist in the roadway cell library have already been scaled twelve times to simplify their insertion into a full-scale drawing. For instance, if a 1"=50' scale is desired, the border is placed at a scale factor of 50 even though the actual scale ratio is 600:1 (12 x 50 = 600). The scale factor of the text style in this situation would be set to 600 through the use of the Annotation Scale. It is not actually necessary for one to make this calculation. The scale factors are pre-defined within the scales definition file (scales.def) in the IDOT CADD configuration.

Setting the Annotation Scale has been greatly simplified for MicroStation v8i. The "Drawing Scale" dialog has been added and may be accessed through the pull-down, "Settings" / "Drawing Scale". From within that dialog, the desired scale can be set and the "Annotation Scale" toggle can be turned on as well. (See Figure 2.6-3). These settings may also be set in the Model Properties dialog as they were in MicroStation v8.
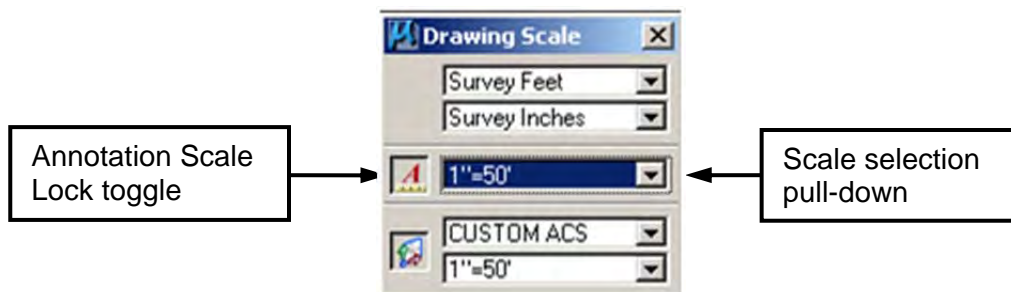

Figure 2.6-3 Model Properties Dialog

One item that should be mentioned here is that the text settings generally should not be overridden. Two exceptions are with the justification and occasionally the underline. Changing other settings defeats the purpose of using text styles.

Another item that should be mentioned here is if the dgnlib update command is run against a file with text or dimension styles, the overrides may inadvertently be switched to the default settings of the associated text styles or dimension styles. Because of this, caution should be exercised if executing this command.

To further simplify the implementation of the new text styles (as much as currently possible), a MicroStation mvba has been written that sets the drawing scale as well as the annotation scale. The notation level may also be changed here should it differ from the active level. This mvba is called by the D&C Manager, through the IDOT Drawing Manager pull-down, or the IDOTMenu pull-down. It may also be run separately using the key-in: vba run [SetTextStyle]TextStyle. Figure 2.6-4 shows how the mvba appears when executed.

Figure 2.6-4 SetTextStyle.mvba

2.7 Dimension Styles

Dimension styles are a feature in MicroStation which simplifies placement of dimensions and promotes uniformity in dimensions. Similar to text styles, the dimension settings are pre-defined inside of "Rdwy_Text.dgnlib". They also require that the annotation scale be set and turned on in order for them to work properly.

There are currently two dimension styles that have been set up. They are listed in Fig. 2.7-1.

Dimension Style Name	Use
Roadway120	General roadway dimensions
Roadway140	Highway Standard dimensions

Fig. 2.7-1 Dimension Styles

The use of Dimension Styles is not required. They may be manually placed.

2.8 Working Units

The working units are now set in survey feet as the master units and survey inches are set as the sub-units in the IDOT seed files. The working units are defined in all IDOT seed files and are extremely important in long distance design file measurements. Along with the working units the importance of the global origin setting of the design file affects the accuracy of the design. The department sets the global origin to x=0, y=0 and z=0 in all of the IDOT seed files.

2.9 Seed Files

The four basic seed files required for the preparation of roadway plans are as follows:
- IDOTeng3d.dgn: English Aerial Survey plans 3D graphics seed file for DTM data
- IDOTmet3d.dgn: Metric Aerial survey plans 3D graphics seed file for DTM data
- IDOTeng.dgn: English roadway plan 2D graphics seed file
- IDOTmet.dgn: Metric roadway plan 2D graphics seed file

Additional information concerning these seed files is available in the README.txt file in the IDOT configuration executable file.

An additional seed file exists in the IDOT configuration. It is as follows:
- IDOTseed.dgnlib: Use this modified IDOTeng.dgn to create DGNLIB's.

2.10 Visual Basic

Several visual basic files are available for use. They are listed and described in the zV8mvba.doc file in the IDOT configuration executable file.

2.11 Cell Libraries

Currently, there are six cell libraries available for use in the preparation of roadway plans. The library primarily used is titled IDOTroad.cel. All of these cell libraries are available in the IDOT configuration executable on the IDOTCADD Support web site.

Adobe Acrobat "pdf" files have been created for the roadway cell libraries. They are available under the Cell Libraries tab on the Roadway CADD Downloads and Guidelines site. Each of the pdf's contain a table of contents with individual images of their cells. The table of contents for each of the libraries contains links to these images.

Several borders exist within the primary roadway cell library, IDOTroad.cel. Fig. 2.11-1 lists the borders that are required for all new jobs.

It is important to note that these borders, as well as the symbols in the roadway cell libraries, have already been scaled twelve times. This was done for convenience. For example, if a 1"=50' scale is chosen, the border is inserted at a scale factor of 50 although the actual scale ratio is 600:1 (12 x 50 = 600).

Cell Name	Description
Sht_1 Plan 2 Profile	Single plan, double profile
Sht_2 Plan 2 Profile	Double plan, double profile
Sht_Cover	Cover sheet
Sht_Double Plan	Double plan
Sht_Double Profile	Double profile
Sht_Full Profile	Profile only
Sht_Ids A	Dist. 2 thru 9 IDS sheet
Sht_Ids B	Dist. 2 thru 9 IDS sheet
Sht_Ids C	Dist 1 IDS sheet (reconstruction)
Sht_Ids D	Dist 1 IDS sheet (new construction)
Sht_Ids D1	Dist 1 IDS sheet
Sht_Plan	Plan only
Sht_Plat Appraisal	Appraisal Plat
Sht_Plat of Hway	Highway Plat
Sht_Plnprof	Single plan, single profile
Sht_Plnprof Urban	Urban single plan, single profile
Sht_Row Easement Plat	Easement Plat
Sht_Row Plans	ROW plans
Sht_Row Plat	ROW Plat
Sht_Triple Profile	Triple profile
XS_Sheet	Cross Sections (Landscape)
XS_Sheet Vertical	Cross Sections (Portrait)

Fig. 2.11-1 Current Roadway Borders

2.12 CADD Roadway and Structure Project Deliverables Policy

A link for the CADD Roadway and Structure Project Deliverables Policy exists on the Roadway CADD Downloads and Guidelines site. It addresses project file requirements, data transfer, coordination, design file management, file naming conventions, as well as

various FAQ's. Both the CADD Roadway Drafting Reference Guide as well as the CADD Structures Drafting Reference Guide are referenced by it.

2.13 Example Plans

Example plans exist on the Roadway CADD Downloads and Guidelines site. They are to be used as an aid in the preparation of plans. For each possible sheet type, there is a page containing general comments pertaining to it. That is followed by an example of how that particular sheet type should appear.

2.14 Printing

The plan sheet borders included in the department roadway cell library "IDOTroad.cel" have been designed to facilitate the use of batch printing. The cells include a shape construction element that is on the outermost perimeter of the border to be used for the creation of ANSI B and D-sized prints. This element exists on the level "Sheets_Printer Plotting Border."

Figure 2.13-1 is a table showing the line thicknesses used on full-size (ANSI D) prints. The line weights for quarter-size (ANSI B) plans should be set to one-half of these values.

In a similar manner, Figure 2.13-2 is a table showing the line strokes used on full-size (ANSI D) prints for defining MicroStation's built-in line codes. The line strokes for quarter-size (ANSI B) plans should be set to one-half of these values.

Weight	Thickness	Thickness	Pen
WT =	(in)	(mm)	Size
0	0.010	0.250	000
1	0.014	0.350	0
2	0.020	0.500	1
3	0.024	0.600	2
4	0.031	0.800	3
5	0.047	1.200	4

Figure 2.13-1. Line Thicknesses for ANSI D-size Prints

Line Code	Line	Space	Line	Space	Line	Space
LC =	(in)	(in)	(in)	(in)	(in)	(in)
1	0.015	0.0394				
2	0.0788	0.0788				
3	0.1574	0.0788				
4	0.1574	0.0788	0.0236	0.0788		
5	0.0552	0.0552				
6	0.1574	0.0552	0.0394	0.0552	0.0394	0.0552
7	0.1574	0.0552	0.0552	0.0552		

Figure 2.13-2. Line strokes for ANSI D-size Prints

3. GEOPAK Information

3.1 GEOPAK

GEOPAK is a comprehensive software package that covers every project phase from conceptualization to final quantities. The software works within the MicroStation graphic environment providing true interactive design. For example, a horizontal alignment can be created graphically; it can be calculated with the coordinate geometry component of GEOPAK or some interactive combination of the two. Dynamic on-screen design provides immediate interpretation of plan view geometrics for making design choices through visualization.

Using GEOPAK will help ensure consistency and accuracy of design work and generate significant timesaving in the overall effort of producing construction plans.

3.2 File Names

GEOPAK uses and/or creates files during the design process. The files are detailed below.

job###.gpk	This binary file is created when the user starts a coordinate geometry (COGO) session for the first time or through Project Manager and may be appended to during the design process. All coordinate geometry elements are stored in this file. Multiple users can access this file at the same time, and only one file should be created for each project. The "###" is the only variable in this name. It represents a job number (up to 3 alphanumeric characters) unique to a project and is defined by the user upon creation.
fname.inp **Example: desxs.inp**	Any ASCII input file for running GEOPAK processes. Fname is user defined with an .inp extension.
fname###.ioc **Example: align999.ijd**	ASCII input file for loading data during a COGO session. "###" represents the job number and "oc" is the operator code (users initials).
fname###.ooc **Example: align999.oho**	ASCII output file created by GEOPAK during a COGO session. Variables are the same as defined above.
fname.dat	A binary file that contains string and point information to be used for digital terrain model construction.
fname.tin	A binary file containing triangular surfaces also known as the digital terrain model (DTM).
project.prj	Binary file resulting from the creation of a new project.

3.3 GEOPAK Database (GPK)

The gpk file is the main project related GEOPAK file. It is usually stored in ProjectWise in **IDOT Offices\District ?\Projects\????\CADData\GEOPAK Project Mgr\GPK** or the working directory. When users are first involved in a project they should closely examine what information is presently available in the existing .gpk.

3.4 Design and Computation Manager

GEOPAK's Design and Computation Manager (D&C Manager) is a tool that may be used to draw features into a MicroStation design file using preset attributes and a designated GPK file. The D&C Manager is similar to the MicroStation Settings Manager, in that it can be used to draw a feature into a drawing setting the attributes of that specific feature to the current IDOT Drafting Standards. The default database for the D&C Manager should be **IDOTCAD\Geofiles\Database\IdotRoad.ddb**. The following outlines describe the general hierarchies of the database.

IdotRoad.ddb
- Plan Topo & Notation
    - Alignments
    - Alignments Plats and Plans
    - Adjustment Items
    - Boundaries
    - Construction Pavement Details
    - Construction Signing
    - Contours
    - Drainage
    - General Details & Plan Sheets
    - Highway Lighting Details
    - Landscaping
    - Non-Highway Improvements
    - Pavement Marking
    - Profiles
    - Railroad Details
    - Removal Items
    - Right of Way
    - Roadside Existing
    - Roadway Existing
    - Roadway Plan Notation
    - Structure Improvement
    - Traffic Sheet Details
    - Traffic Signal Details
    - Underground Utilities
    - Utilities
    - Vegetation
    - Water Features
    - XS Pattern Lines
- Plan Pay Items
    - Quantities
        - Drainage
        - Highway Lighting Details
        - Landscaping

- Pavement Marking
- Railroad Details
- Right of Way
- Roadside Improvements
- Roadway Improvements
- Signing
- Structure Improvement
- Traffic Sheet Details
- Traffic Signal Details
- Underground Utilities
- Utilities
- Special Applications (See Section 3.18 for further explanation)
- GEOPAK Lines

The D&C Manager has several advantages over the MicroStation Settings Manager; The D&C Manager draws COGO features quickly, has been set up to include most of the state pay code numbers to perform quantity calculations (only underneath the Plan Pay Items folder) and has advanced highlighting capabilities.

3.5 Survey Manager

The **Survey Manager Database (SMD)** file is used in the translation of data from survey data collectors to MicroStation Design files using GEOPAK Survey. To begin the translation of data, the operator invokes the *User Preferences* from Applications>GEOPAK Road>User Preferences. Within the *User Preferences* dialog box press the Feature Preferences button. In the Feature Preferences dialog box the SMD Feature File path should be set to **IDOTCAD\Geofiles\Database\IdotSurvey.smd**. The "Apply Feature Best Match" toggle should be turned on and the "Plot Scale" should be set to the appropriate factor. For _rural_ projects the scale should be set to 50 and for _urban_ projects the scale should be set to 20. The .SMD file is protected and cannot be edited. If any CADD operators have a need for additional items to be added into the .SMD file they should contact an IDOT District Survey support person. The feature codes, used by field personnel to enter data into their data collectors, are listed in the file IDOTCAD\Geofiles\Database\IDOTSurvey.xls.

Linking Codes
The linking codes need to be set in the Survey Project Preferences dialog box. They can be found under the Dataset tab in the Linking Codes item. Contact the appropriate district survey office for standards to be used.

3.6 Project Manager

Project Manager is a GEOPAK tool that associates a project with its respective .gpk job number, users, working directories and project files. This organization of the project keeps the user from having to maintain the different files and their locations associated with a particular project. In addition, many of the GEOPAK functions can be invoked by simply pressing the appropriate button from the dialog, which is set up in a workflow or tool box format. When invoked, all previously defined data is displayed within the appropriate fields, saving the user the repetitive typing of frequently used information. Each processing of a particular dialog can be saved to a "run" and recalled via a simple pull down menu. The data for a project is stored in a file with the format *.PRJ, where * is a one to eight character alphanumeric name with no spaces. A new directory named PROJDBS is created (if necessary) under the current project directory. This directory

stores the information for the users that have been created.

3.7 Drainage Library

GEOPAK Drainage is a comprehensive system for designing and analyzing storm drain systems, which can leverage many roadway design features to create a seamless information exchange to the drainage design process. A GEOPAK Drainage project may contain multiple drainage networks; each comprised of any number of topologically connected drainage areas, inlets, pipes and ditches. The GEOPAK Drainage workflow closely mirrors conventional design processes allowing for the design of the surface collection system (i.e. drainage areas, inlets) then the design of the subsequent conveyance system. The *Drainage Library* contains the Rainfall Parameters, standard inlet types, standard pipes configurations, spread sections, and land use symbology tables. All of these items are merely referenced by each project to accommodate standardization and information sharing among projects. The default *Drainage Library* for GEOPAK Drainage should be **IDOTCAD\Geofiles\Drainage\IDOT_Drainage.dlb**.

3.8 Profile Preferences

The *Profile Preferences* are the Stopping Sight Distance K-values for crest and sag conditions for specified design speeds. IDOT uses the K-values found in the AASHTO 2001 edition of A Policy on Geometric Design of Highways and Streets. The default IDOT *K-value Table* is **IDOT_KValues_2001english.kvl** and can be found in **IDOTCAD\Geofiles\Profiles**. The Geopak tools that use this table for calculations are the COGO Print Profile command, Design & Computation Manager Plan/Profile Draw, Vertical Alignment Generator, Profile Labeler and Draw Profile.

3.9 Superelevation Tables

IDOT uses the AASHTO Method 5 radius tables to calculate the superelevation rate and length of runoff. The *Superelevation Tables* that IDOT uses can be found in the **IDOTCAD\Geofiles\SE_Tables\English** folder. The **IDOT_2001_English.sep** file located in **IDOTCAD\Geofiles\SE_Tables\English** is the Superelevation Preferences file that sets the various options for the e method, Runoff Length, Tangent Runout, Adjust Factors, Distribution, Rotation, Compound Curves and Short Curves.

3.10 Legal Description Editor

The Legal Description Editor is a GEOPAK tool that may be used to create Right of Way legal descriptions utilizing GEOPAK coordinate geometry, and predefined styles. The default IDOT Legal Description Library is **IDOTLegalEnglish.ldb** found in **IDOTCAD\Geofiles\Legal**. The general statements that are common to all descriptions are stored in the GEOPAK library. The Editor receives information unique to certain parcels from the GPK file, key-in, or lists provided in dialog boxes. Legal descriptions and parcel data are typed one time and stored in GEOPAK. The Legal Description Editor can be used once the parcel is stored. Points, curves, and parcels must be stored in GEOPAK before using the Legal Description Editor. The Legal Description Editor is found in GEOPAK Road or GEOPAK Site under "\Geometry\Legal Description".

3.11 Plan Sheet Layout

GEOPAK Plan and Profile Sheet Layout provides an automated tool to generate IDOT standard plan and profile sheets from plan and profile view graphics. Each plan, profile and tabular data is referenced into the sheet design file to compile the plan and profile sheets. Four sheet libraries have been configured for IDOT use with IDOT's standard plan and profile sheet cells.

IdotPlanSheets.psl (default) .... English Sheets, no match line (22" x 34")
IdotPlanSheetsML.psl .... English Sheets with match line (22" x 34")
IdotPlanSheetsMetric.psl .... Metric Sheets, no match line (22" x 34")
IdotPlanSheetsMetricML.psl .... Metric Sheets with match line (22" x 34")

The IDOT Plan Sheet library is located in the following directory:

\IDOTCAD\Geofiles\Sheets\Plan. If a sheet library other than the default is needed, use File>Attach to attach the desired library.

The table below lists the sheet layouts that are presently available:

IdotPlanSheets.psl

1P&1P Short (2 Grid) .... 1 - 30" Long Plan and 1 - 2 Scale Profile
1P&1P Long (2 Grid) .... 1 - 31.63" Long Plan and 1 - 2 Scale Profile
1P&1P Short (5 Grid) .... 1 - 30" Long Plan and 1 - 5 Scale Profile
1P&1P Long (5 Grid) .... 1 - 31.63" Long Plan and 1 - 5 Scale Profile
1P&1P Short (10 Grid) .... 1 - 30" Long Plan and 1 - 10 Scale Profile
1P&1P Long (10 Grid) .... 1 - 31.63" Long Plan and 1 - 10 Scale Profile
1P&2P Short (2 Grid) .... 1 - 30" Long Plan and 2 - 2 Scale Profiles
1P&2P Long (2 Grid) .... 1 - 31.63" Long Plan and 2 - 2 Scale Profiles
1P&2P Short (5 Grid) .... 1 - 30" Long Plan and 2 - 5 Scale Profiles
1P&2P Long (5 Grid) .... 1 - 31.63" Long Plan and 2 - 5 Scale Profiles
1P&2P Short (10 Grid) .... 1 - 30" Long Plan and 2 - 10 Scale Profiles
1P&2P Long (10 Grid) .... 1 - 31.63" Long Plan and 2 - 10 Scale Profiles
2P&2P Short (2 Grid) .... 2 - 30" Long Plans and 2 - 2 Scale Profiles
2P&2P Long (2 Grid) .... 2 - 31.63" Long Plans and 2 - 2 Scale Profiles
2P&2P Short (5 Grid) .... 2 - 30" Long Plans and 2 - 5 Scale Profiles
2P&2P Long (5 Grid) .... 2 - 31.63" Long Plans and 2 - 5 Scale Profiles
2P&2P Short (10 Grid) .... 2 - 30" Long Plans and 2 - 10 Scale Profiles
2P&2P Long (10 Grid) .... 2 - 31.63" Long Plans and 2 - 10 Scale Profiles
1P&1P U Short (2 Grid) .... 1 - 30" Long Urban Plan and 1 - 2 Scale Urban Profile
1P&1P U Long (2 Grid) .... 1 - 31.63" Long Urban Plan and 1 - 2 Scale Urban Profile
1P&1P U Short (5 Grid) .... 1 - 30" Long Urban Plan and 1 - 5 Scale Urban Profile
1P&1P U Long (5 Grid) .... 1 - 31.63" Long Urban Plan and 1 - 5 Scale Urban Profile
1P&1P U Short (10 Grid) .... 1 - 30" Long Urban Plan and 1 - 10 Scale Urban Profile
1P&1P U Long (10 Grid) .... 1 - 31.63" Long Urban Plan and 1 - 10 Scale Urban Profile
1 PLAN ....Single Plan Sheet
2 PLAN .... Double Plan Sheet
2 PLAN Staging.. Double Plan Sheet for Staging

2 PROFILE .... Double Profile Sheet

3 PROFILE .... Triple Profile Sheet

FULL PROFILE (2 grid) .... Full 2 Scale Profile Sheet

FULL PROFILE (5 grid) .... Full 5 Scale Profile Sheet

FULL PROFILE (10 grid) .... Full 10 Scale Profile Sheet

IdotPlanSheetsML.psl

1P&1P ML (2 Grid) .... 1 - 31.63" Long Plan with Match line and 1 - 2 Scale Profile

1P&1P ML (5 Grid) .... 1 - 31.63" Long Plan with Match line and 1 - 5 Scale Profile

1P&1P ML (10 Grid) .... 1 - 31.63" Long Plan with Match line and 1 - 10 Scale Profile

1P&2P ML (2 Grid) .... 1 - 31.63" Long Plan with Match line and 2 - 2 Scale Profiles

1P&2P ML (5 Grid) .... 1 - 31.63" Long Plan with Match line and 2 - 5 Scale Profiles

1P&2P ML (10 Grid) .... 1 - 31.63" Long Plan with Match line and 2 - 10 Scale Profiles

2P&2P ML (2 Grid) .... 2 - 31.63" Long Plans with Match lines and 2 - 2 Scale Profiles

2P&2P ML (5 Grid) .... 2 - 31.63" Long Plans with Match lines and 2 - 5 Scale Profiles

2P&2P ML (10 Grid) ....2 - 31.63" Long Plans with Match lines and 2 - 10 Scale Profiles

1P&1P Urbn ML (2 Grid) ....1 - 31.63" Long Urban Plan with Match line and 1 - 2 Scale Urban Profile

1P&1P Urbn ML (5 Grid) ....1 - 31.63" Long Urban Plan with Match line and 1 - 5 Scale Urban Profile

1P&1P Urbn ML (10 Grid) ...1 - 31.63" Long Urban Plan with Match line and 1 - 10 Scale Urban Profile

1 PLAN Match line .... Single Plan Sheet with Match lines

2 PLAN Match line .... Double Plan Sheet with Match lines

2 PLAN Stage Match line .... Double Plan Sheet for Staging with Match lines

3.12 Plan Sheet Labeling

GEOPAK's Plan View labeling tool allows a user to place "smart" labels in a MicroStation plan drawing. These labels have the ability to calculate XYZ coordinates, station, offset, direction, length, radius, degree of curvature, etc. of the associated element. Frequently utilized labels can be stored as Label Styles for subsequent recall. The complete label, including computed text inserts, user inserts, shapes, and leaders, are all stored within the Style. The default IDOT *Plan View Labeling Style* file is **IDOT_plan.lsf** and can be found in **IDOTCAD\Geofiles\Labelers**.

3.13 Cross Section Sheet Layout

The GEOPAK Cross Section sheet layout command provides an automated tool to generate IDOT standard cross section sheets from cross section graphics. Each cross section is referenced into the sheet design file to compile the cross section sheets and labels such as baseline, station, offsets and elevation are added. Additionally, the process can also be used to place earthwork quantities as the sheets are generated.

The sheet library **IdotXsecSheets.xssl** has been configured for IDOT use with IDOT's standard cross section sheet cells. The library is located in the following directory: **\IDOTCAD\Geofiles\Sheets\ XSection**.

The following default sheet values have been defined in IdotXsecSheets.xssl:

Active Cross section Sheet	Horizontal Scale	Vertical Scale	Width	Height
5 SCALE HORIZONTAL	5	2.5	34.00	22.00
5 SCALE VERTICAL	5	2.5	22.00	34.00
10 SCALE HORIZONTAL	10	5	34.00	22.00
10 SCALE VERTICAL	10	5	22.00	34.00
20 SCALE HORIZONTAL	20	10	34.00	22.00
20 SCALE VERTICAL	20	10	22.00	34.00

3.14 Cross Section Labeling

GEOPAK's Cross Section labeling tool allows a user to place "smart" labels in a MicroStation cross section drawing. These labels have the ability to calculate XY coordinates, station, offset, elevation, slope, chain name, etc. of the associated element. Frequently utilized labels can be stored as Label Styles for subsequent recall. The complete label, including computed text inserts, user inserts, shapes, and leaders, are all stored within the Style. The default IDOT *Cross Section Labeling Style* file is **IDOT_xs.lsf** and can be found in **IDOTCAD\Geofiles\Labelers**.

3.15 Typical Section Generator

This feature within proposed cross sections was originally developed in order to automate (as much as possible) the development of cross sections for widening and resurfacing jobs, but it can also be used with new construction. It enables the user to select a typical section from a cell library, and then copies associated criteria files into the job directory. In addition, the criteria files are placed within the definition of the "side slope lt" and "side slope rt" statements. The results are that the user only has to specify the project values for the given variables, and then initiate the proposed cross section run. The *Typical Section Generator* can only be accessed through Project Manager. All of IDOT's Typical Sections are in the folder **Typicals_E** in **IDOTCAD\Geofiles**.

The following Typical Section Templates have been created for IDOT:

Typical Section Template Name	Description
GRAILD	**G**uard**RAIL** for rural **D**ivided areas
OLLNPR	**O**ver**L**ay **L**eft **N**ew Bituminous **P**avement **R**ight
OLRNPL	**O**ver**L**ay **R**ight **N**ew Bituminous **P**avement **L**eft
RDNBIT	**R**ural **D**ivided **N**ew **Bit**uminous pavement
RDNORS	**R**ural **D**ivided **NO** **R**e-**S**urfacing proposed shoulders and ditches
RDNPCC	**R**ural **D**ivided **N**ew **PCC** (Concrete)
RESUME	**Res**urfacing **U**ndivided **M**atch **E**xisting
RESUSC	**Res**urfacing **U**ndivided **S**lope **C**orrection
RSDCDW	Rural **R**e-**S**urfacing **D**ivided slope **C**orrection with proposed shoulders, **D**itches and **W**idening
RSDMEW	**R**e-**S**urfacing **D**ivided **M**atch **E**xisting with **W**edges
RSDSCD	Rural **R**e-**S**urfacing **D**ivided **S**lope **C**orrection with proposed shoulders and **D**itches
RSDSCW	**R**e-**S**urfacing **D**ivided **S**lope **C**orrection **W**edges
RSUCDW	Rural **R**e-**S**urfacing **U**ndivided slope **C**orrection with proposed shoulders, **D**itches and **W**idening
RSUMDW	Rural **R**e-**S**urfacing **U**ndivided **M**atch **E**xisting with proposed shoulders, **D**itches, and **W**idening
RSUMED	Rural **R**e-**S**urfacing **U**ndivided **M**atch **E**xisting with proposed shoulders and **D**itches
RSUSCD	Rural **R**e-**S**urfacing **U**ndivided **S**lope **C**orrection with proposed shoulders and **D**itches
RSUSCW	**R**e-**S**urfacing **U**ndivided **S**lope **C**orrection with **W**idening
RUNBIT	**R**ural **U**ndivided **N**ew **Bit**uminous
RUNORS	**R**ural **U**ndivided **NO** **R**e-**S**urfacing proposed shoulders and ditches
RUNPCC	**R**ural **U**ndivided **N**ew **PCC** (Concrete) construction
RUSCNL	**R**ural **U**ndivided **S**lope **C**orrection with **N**ew Bituminous **L**anes
UDNBIT	**U**rban **D**ivided **N**ew **Bit**uminous
UDNPCC	**U**rban **D**ivided **N**ew **PCC** (Concrete)
UDRSWD	**U**rban **D**ivided **R**e-**S**urfacing with optional **W**idening and urban shoulders and proposed **D**itches
ULRRSC	**U**rban **L**eft **R**ural **R**ight undivided **S**lope **C**orrection with new bituminous lanes
UMRSBT	**U**rban **M**edian **R**ural outside **S**houlders **Bit**uminous new divided pavement
UMRSPC	**U**rban **M**edian **R**ural outside **S**houlders **PCC** new divided pavement
URRLSC	**U**rban **R**ight **R**ural **L**eft undivided **S**lope **C**orrection with new bituminous lanes

Typical Section Template Name	Description
UUNBIT	**U**rban **U**ndivided **N**ew **Bit**uminous
UUNPCC	**U**rban **U**ndivided **N**ew **PCC** (Concrete)
UURSWD	**U**rban **U**ndivided **R**e-**S**urfacing with optional **W**idening and urban shoulders and proposed **D**itches
UUSCNL	**U**rban **U**ndivided **S**lope **C**orrection with **N**ew Bituminous **L**anes

3.16 Earthwork

GEOPAK provides the capabilities to calculate earthwork quantities from cross section elements or from DTM volume differences.

In order to compute earthwork, GEOPAK requires:

- MicroStation design file containing proposed cross section and existing ground lines.
- GEOPAK coordinate geometry database file (.gpk) if the baseline used to generate the cross sections has station equations.

GEOPAK computes earthwork using the Average End Area Method by reading and interpreting the MicroStation design files containing proposed and existing ground cross sections. This approach affords the user maximum flexibility in that it is irrelevant whether the cross section elements were created entirely by GEOPAK or were created or modified using generic MicroStation commands. GEOPAK can compute earthwork volumes from any reasonable graphical representation of a cross section.

Cut/Fill quantities can be computed from very simple graphical cross sections as well as very complex cross sections using several types of unsuitable or removal materials and several fill material types.

GEOPAK is extremely flexible when computing earthwork, using several types of excavation and fill, numerous material types (known as soil types), and different shrink/expansion factors. In order to tell the software how to compute earthwork, a thorough understanding of these concepts is necessary.

Excavation Types

Several types of excavation are supported in GEOPAK. These include:

- **Common excavation –** Excavation volumes that are not backfilled with an earthwork material. This includes the excavation required for cut sections as well as for pavement thickness, shoulder thickness, etc.
- **Subgrade excavation –** Excavation volumes that are backfilled with an earthwork material
- **Subsoil excavation –** Excavation required to remove unsuitable material either 1) down to the bottom of the proposed cross section or 2) down to the bottom of the unsuitable material layer

Embankment Types

In addition to the excavation types, GEOPAK determines where fill material is required. The user does not specify where embankment is required as GEOPAK determines it from the graphic elements in the MicroStation cross section design file.

Functional Classes

Functional classes identify the function or purpose of the cross section element. In order to compute the most basic earthwork, two functional classes are required. They are:

- Proposed Finished Grade
- Existing Ground

Functional classes are determined by the designer. With each functional class, additional project-specific information must be supplied in order for GEOPAK to compute the quantities. The information required includes:

- Soil Type
- Element Symbology of the Material
- Shrink/Swell Factors

3.17 Digital Terrain Model

A **Digital Terrain Model (DTM)** represents the topography data of a project from which a TIN can be extracted. The DTM can be drawn in a 3D file, and then rotated to see the existing surface of the project area. DTM's are often used for drawing cross sections and earthwork. Usually DTM's are needed for both existing and as-built ground surfaces.

Triangulated Irregular Network (TIN) is derived from mass points and break-line data by means of a mathematical process that forms triangles representing the terrain surface. The triangulated model is stored in a binary file as a triangulated irregular network. GEOPAK DTM files are named with a .tin extension.

GEOPAK provides the capability to generate a DTM from a wide range of data sources including MicroStation elements, survey data, photogrammetric data, GEOPAK cross sections or ASCII files with X,Y,Z coordinates. For most design projects, a DTM will be provided from IDOT's District Survey personnel, central office Aerial Surveys Unit or from a contracted engineering consultant.

The DTM is used by GEOPAK to extract existing ground profiles and cross sections, display contours, display drainage flow patterns, etc.

3.18 Special Applications

In IDOT's Design and Computation Manager database **IdotRoad.ddb**, is a section called *Special Applications* that contains links to MicroStation vba applications or Geopak 3 port criteria files developed by either IDOT or outside sources. The following is a list of the *Special Applications* available for use.

Application Name	Description
AsciiOffset	Generates an ASCII file with point type, chain name, station, offset, XY coordinates, and type of element for the lines in plan view at a keyed in interval along the centerline chain.
Chain_Chk	Generates a report of Ahead and Back direction information of a GEOPAK chain and reports on bearing mismatches.
ChainTable	Generates a table of coordinates and curve data for the control points of a selected GEOPAK Chain.
CheckSightDist	Checks the Sight Distance on a GEOPAK Profile based on a user selected Design Speed.
ContourLabelEditor	Edit labels of contours.
CurveWidening	Using a GEOPAK superelevation shapes input file, calculate Curve Widening in accordance with **AASHTO 2004** and draw to plan view.
GPK_Merge	Merge all elements or selected elements of one gpk file into another.
LabelProfileMis	Label station equations, high and low points on selected profile.
LockNew	Automatically lock all handwork after setting a mark in the MicroStation file. Also highlight or add locked elements to a MicroStation selection set.

Application Name	Description
PI_Angle	Compute angles between any three points either graphically, by COGO, or by keyins.
ProfileGrid	Draw an IDOT profile grid on a GEOPAK profile cell in a MicroStation file.
SheetLabeler	Label an IDOT Plan Sheet title block (22x34).
OldSheetLabeler	Label an older IDOT Plan Sheet title block (23x36).
RemoveData	Remove and or highlight previously attached GEOPAK D&C, COGO or ADHoc attributes from elements.
FeatureXS	On the fly cross sections of topo attributes.
XSLabeler	Label an IDOT Cross Section Sheet title block (22x34).
OldXSLabeler	Label an older IDOT Cross Section Sheet title block (23x36).
XSFoldLine	XS Fold Line for proposed cross-sections that are too wide to show entirely on the cross section sheet cell.
XSMovie	Drive through the 2d cross sections.
XSTaperTable	Cross-section taper table.

4. Summary of Quantities

Until recently, there has been no direction concerning the presentation of the Summary of Quantities within design plans. While this may not seem to be important to some, it does become very important when and if quantities of a project must be adjusted by the Department before going to Letting. For this reason, minimum requirements are being provided in Section 4.2.

After working with plans using the previous requirements, it was determined that more space was needed for each row of the tables, thus reducing the number of pay items listed on each sheet of quantities. The information in sections 4.1 and 4.2 have been updated to reflect these changes.

4.1 Coded Pay Item Resources

The coded pay items are available as Adobe Acrobat (.pdf) files, Excel (.xlsx) files and text (.txt) files. The data in these files can be manipulated and brought into the Summary of Quantities sheet(s) in MicroStation by various means. This data is maintained by the Bureau of Design and Environment.

An additional tool that is being made available is an Excel macro spreadsheet named "English_SOQ_*mm_dd_yyyy*". (Note that a new pay item list is created for each letting). It is available under the Summary of Quantities Spreadsheets tab of the Roadway CADD Downloads and Guidelines site. This spreadsheet also contains all of the coded pay items. The macro takes the selected items and generates Summary of Quantities table(s), including the grid(s), in the file while removing the unselected coded pay items. The resulting text can be copied into MicroStation using the new cell, "SUMMARY_OF_QUANTITIES" located in the roadway cell library "IDOTroad.cel" (Note that this cell has been scaled 12X to be consistent with all other cells within the cell library). Third party software may be used instead in order to bring the resulting table and text into MicroStation. If using this macro spreadsheet, ensure that the date updated matches that of the data maintained by the Bureau of Design and Environment.

The basic procedure for using the macro spreadsheet is included in the "Instructions" tab within the spreadsheet.

4.2 Requirements

The minimum requirements for all Summary of Quantities sheets:

- A grid must be used such as that generated by the Excel macro spreadsheet or the cell, "SUMMARY_OF_QUANTITIES" located in the roadway cell library. (Columns of the table cell may be added, removed, or modified as required)
- Coded pay item numbers, descriptions, units, and quantities must use the text style "Rdwy_SOQ140" or its equivalent
- Coded pay items must be double-spaced (i.e. a blank line before the first pay item and after the last pay item as well as between each row of coded pay items)
- The full description (not the abbreviated description) of the pay items must be used in the Summary of Quantities

Reference the Summary of Quantities in the example plans on the Roadway CADD Downloads and Guidelines site for an example of the desired appearance.

5. Internet Information

5.1 Web Page

Many of the resources necessary to design and detail both roadways and structures are available under the [Consultant Resources](#).

5.2 Subscription Service

Signing up for the IDOT CADD Support Subscription Service is strongly encouraged. Notifications are sent out via e-mail whenever changes are made to items on the Roadway CADD Downloads and Guidelines web page. You may subscribe by expanding "Stay Connected" under the "Support" tab of the [Roadway CADD Downloads and Guidelines](#).

6. File Transfer

File transfers may be made by CD, DVD, posted to the IDOT ProjectWise Web Server, or uploaded to the Illinois.gov file transfer utility. Contact the district office that you are doing business with to determine their document transfer preference.

6.1 ProjectWise Web Explorer

Individuals may be directed to send or receive files using the IDOT ProjectWise Web Explorer. Information on how to register as well as instructions on its access and use may be found by expanding "ProjectWise" under the "Support" tab of the Roadway CADD Downloads and Guidelines site.

It is important to note that the version of ProjectWise Web Server that the Department is currently running is only documented to work with Internet Explorer 6 through 8.

6.2 Illinois.Gov File Transfer Utility

The State of Illinois' file transfer utility for files up to 2GB is found at https://filet.illinois.gov/filet/PIMupload.asp . Instructions for its use are located on that site.

7. District and Central Office CADD Manager Contact Information

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